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Total number of printed pages – 2

B. Tech.
BEME 2209

Third Semester Examination – 2010

FLUID MECHANICS AND MACHINES

Full Marks – 70

Time : 3 Hours

Answer Question No. 1 which is compulsory and any **five** from the rest.

The figures in the right-hand margin indicate marks.

1. Answer the following questions : 2×10
- (a) What are the units of viscosity in SI and MKS unit? How they are related?
- (b) How viscosity of the liquid varies with temperature?
- (c) When will centre of pressure and centre of gravity of an immersed plane surface coincide?
- (d) What are the conditions of different equilibrium of sub-merged body?
- (e) What do you mean by local acceleration?
- (f) How the velocity of a point is determined by pitot-tube?
- (g) What are the speed ratio and flow ration?
- (h) Explain hydraulic and overall efficiency of turbine?
- (i) What are manometric and mechanical efficiency of pump?
- (j) List out the differences between notches and weirs.
2. (a) Find out the minimum size of glass tube that can be used to measure water level if the capillary rise in the tube is to be restricted to 2 mm. Consider surface tension of water in contact with air as 0.073575 N/m.

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- (b) A tank contains water upto a height of 0.5 m above the base. An immisible liquid of sp. gr. 0.8 is filled on the top of water up to 1 m height. Calculate total pressure on one side of the tank. 5
3. Find the density of a metallic body which floats at the interface of mercury of sp. gr. 13.6 and water such that 40% of its volume is sub-merged in mercury and 60% in water. 10
4. If for a two-dimensional potential flow, the velocity potential is given by $\phi = x(2y-1)$. Determine the velocity at the point P (4, 5). Determine also the value of stream function ψ at the point P. 10
5. A nozzle of diameter 20 mm is fitted to a pipe of diameter 40 mm. Find the force exerted by the nozzle on the water which is flowing through the pipe at the rate of $1.2 \text{ m}^3/\text{minute}$. 10
6. A 137 mm diameter jet of water issuing from a nozzle impinges on the buckets of a Pelton wheel and the jet is deflected through an angle of 165° by the buckets. The head available at the nozzle is 400 m. Assuming co-efficient of velocity as 0.97, speed ratio as 0.46, and reduction in relative velocity while passing through buckets as 15%, find :
- (a) The force exerted by the jet on buckets in tangential direction 10
- (b) The power developed.
7. Two geometrically similar pumps are running at the same speed of 1000 r.p.m. One pump has an impeller diameter of 0.30 meter and lifts water at the rate of 20 liters per second against a head of 15 meters. Determine the head and impeller diameter of the other pump to deliver half the discharge. 10
8. Write short notes on the followings : 5×2
- (a) Hydraulic accumulator
- (b) Hydraulic ram.